Missouri Department of Natural Resources

Total Maximum Daily Load (TMDL)

for

Pleasant Hill Lake,
Cass County, Missouri

Completed September 20, 2001
Approved November 19, 2001

Total Maximum Daily Load (TMDL)
For Pleasant Hill Lake
Pollutant: Chlordane

Name: Pleasant Hill Lake

Location: Between Pleasant Hill and Lake Winnebago
in Cass County, Missouri

Hydrologic Unit Code (HUC): 10290108-060003

Water Body # (WBID): 7211

Missouri Lake Class: L1[1]

Beneficial Uses[2]:

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life and Human Health associated with Fish Consumption
- Boating and Canoeing
- Drinking Water Supply

Size of Impaired Segment: 115 acres

Location of Impaired Segment: Mostly contained in Section 1, T46N, R31W

Pollutant: Chlordane

Pollutant Source: Unknown[3]

TMDL Priority Ranking: Low

1. Background and Water Quality Problems

The first settlers arrived at the site of the town of Pleasant Hill in 1828 and by 1844 it was a thriving village of around 40 people. An old history of the county noted that "Cass County is so well supplied with living streams of water and they are so well distributed that the people of the county could not possible make an improvement upon the arrangement, if they were allowed the privilege and endowed with the power to make a readjustment of the system of streams and

[1]Class L1 lakes are lakes used primarily for public drinking water supply. See Missouri's Water Quality Standards 10 CSR 20-7.031(1)(F)
[2] The beneficial uses may be found at 10 CSR20-7.031 (1)(C) and Table G
[3] The 1998 303(d) list gave "Urban nonpoint runoff " as the pollutant source. This is an error and will be corrected on the 2002 303(d) list.

watercourses."[4] The county was first named for President Van Buren, whom Missourians were delighted to honor at that time. However, after Van Buren ran as the presidential candidate of the Free Soil party on an anti-slavery platform, the democratic legislature changed the county name to Cass on February 19, 1849. This was to honor Lewis Cass, of Michigan, who was the Democratic presidential candidate in 1848. The Democratic platform included a plank that allowed slavery (General Zachary Taylor defeated Cass in the 1848 election). During the Civil War, a house in Pleasant Hill was used as the local headquarters for the Union and the town suffered all the consequences of a military occupation. Known as the Henley home, the house is still standing today on the outskirts of Pleasant Hill. The town's population at the end of the war (April 1865) was around 500. In October 1865, the Pacific Railroad was completed to Pleasant Hill and caused the town to grow to 2,200 by 1867.

Today, Pleasant Hill (in northeast Cass County) has a population of 3,827 and is surrounded by agricultural lands. Pleasant Hill Lake touches the northern boundary of Cass County and is part of the South Grand River watershed. It was created by damming Wilson Creek in 1948 and was originally formed as a supplementary drinking water supply for the city of Pleasant Hill, which was treating its own water at that time. In 1974, due to deficiencies in its treatment of the water, the city entered into an agreement to purchase water from Lee's Summit.

More than 80 percent of the land immediately surrounding the lake is rocky and wooded with slopes ranging from 14-30 percent. This soil is the Snead-Rock outcrop complex with moderate permeability and rapid runoff. The associated soils around the lake are Oska silty clay loam and Polo silt loam. These exhibit slow and moderate permeability and medium runoff.

Chlordane is the pollutant impairing Pleasant Hill Lake. It is a pesticide that was once widely used for termite control and in agriculture. The substance was applied both in dwellings and around foundations to repel and kill termites, ants and a variety of other insects, especially through the 1970s and 1980s. The U.S. Environmental Protection Agency (EPA) banned chlordane for agricultural uses in 1975 and from all other uses in 1988. Even though it has been banned, chlordane degrades very slowly in the environment. Chlordane is not soluble and is not found in the water column of waterbodies, but attaches to soil and through erosion moves into a waterbody and accumulates in lake or streambed sediments. It bio-accumulates in fish tissue, and bottom-feeding fish, such as carp, become exposed to chlordane due to their feeding or dwelling preferences near chlordane-contaminated sediments. Eating fish contaminated by chlordane will not make a person ill immediately; however, over a long period of time, chlordane may damage the nervous system, digestive system and the liver. It also has produced cancers in laboratory animals.

The source of the chlordane in Pleasant Hill Lake is unknown. Most chlordane impairments are caused by runoff from urban properties where chlordane was used for pest control. There are, however, no urban areas in the watershed of Pleasant Hill Lake. Agricultural lands surround the lake, so the chlordane may have come from the cornfields where it was used to control the corn borer. Chlordane could also have gotten into the lake if an extermination company rinsed out its equipment near the lake, or from a transportation or storage accident. In the early use of chlordane, no one realized the harmful and persistent nature of the pesticide.

[4] The History of Cass and Bates Counties, Missouri, 1883, St. Joseph Steam Printing Co., pg 86

The Missouri Department of Conservation has monitored levels of toxic contaminants in fish from Missouri lakes and rivers since 1984. At that time, the Missouri Department of Conservation discovered elevated levels of chlordane in fish in the Missouri, Mississippi, and Meramec Rivers. The Missouri Department of Conservation provides these sample results to the Missouri Department of Health (DOH) for use in determining health risks to fish consumers. The DOH, in turn, issues fish consumption advisories. The DOH has issued advisories based on pesticide contaminants in fish since 1985. Past DOH fish advisories instructed anglers to limit consumption of fatty fish (carp, catfish, buffalo, drum, suckers and paddlefish) to one meal per week. Trout also have a high level of fat, but are considered safe to eat from anywhere in the state. The DOH issues its fish advisory every year around June-July. The advisory is made available to the public through press releases and may be accessed by calling the DOH at 1-800-392-7245. These advisories are distributed at fairs and published by the Missouri Department of Conservation in the Summary of Missouri Fishing Regulations pamphlet.

Missouri's protocol for removing or down grading an advisory requires at least two years of data. Fish tissue data from Pleasant Hill Lake in the last two years shows chlordane has been below the 0.3 milligrams per kilogram (mg/kg) action level (See Specific Criteria in Section 2). As a result, the Missouri Department of Health discontinued the warning on fatty fish in the latest fish advisory, which was released July 9, 2001.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Targets

Beneficial Uses

The beneficial uses of Pleasant Hill Lake, WBID 7211, are:

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life and Human Health associated with Fish Consumption
- Boating and Canoeing
- Drinking Water Supply.

The use that is impaired is Protection of Human Health associated with Fish Consumption. Chlordane is not soluble in water and therefore is not a concern for boating or drinking water.

Anti-degradation Policy

Missouri's Water Quality Standards include the Environmental Protection Agency (EPA) "three-tiered" approach to anti-degradation, which may be found at 10 CSR 20-7.031(2).

Tier I defines baseline conditions for all waters and it requires that existing beneficial uses are protected. TMDLs would normally be based on this tier, assuring that numeric criteria (such as dissolved oxygen and ammonia) are met to protect uses.

Tier II requires that no degradation of high-quality waters occur unless limited lowering of quality is shown to be necessary for "economic and social development." A clear implementation policy for this tier has not been developed, although if sufficient data on high-

quality waters are available, TMDLs could be based on maintaining existing conditions, rather than the minimal Tier I criteria.

Tier III (the most stringent tier) applies to waters designated in the water quality standards as outstanding state and national resource waters; Tier III requires that no degradation under any conditions occurs. Management may prohibit discharge or certain polluting activities. TMDLs would need to assure no measurable increase in pollutant loading.

This TMDL will result in the protection of existing beneficial uses, which conforms to Missouri's Tier I anti-degradation policy.

Specific Criteria

The specific criteria for chlordane are found in Missouri's Water Quality Standards, 10 CSR 20-7.031, Table A, under Persistent, Bioaccumulative, Man-made Toxics. The limit for chlordane *in water* related to human health protection associated with fish consumption is 0.00048 micrograms per liter (µg/L or parts per billion). However, elevated chlordane levels in water have never been a problem. As chlordane tends to bioaccumulate in fish, this TMDL will be based on fish tissue chlordane levels. Fish tissue levels refer to the amount of chlordane in the fillet, or edible portion, of fish. The U.S. Food and Drug Administration (FDA) developed a fish tissue action level of 0.3 milligrams per kilogram (mg/kg or parts per million) for technical grade chlordane.[5] Note: 1 kilogram equals approximately 2.2 pounds. If the level of a toxic contaminant exceeds the action level, a fish consumption advisory is issued for the potential health risk associated with long-term consumption of contaminated fish. The first documented exceedence for chlordane in Pleasant Hill Lake was in 1985, and a fish consumption advisory was issued. As noted previously, Missouri's protocol for removing or down grading an advisory requires at least two years of chlordane data below 0.3 mg/kg. Since this requirement has been met, the advisory was discontinued July 9, 2001.

3. Calculation of Load Capacity, Load Allocation and Waste Load Allocation

Load capacity is defined as the maximum pollutant load that a waterbody can assimilate and still attain water quality standards. EPA banned the use of chlordane in 1988, so no additional chlordane is being introduced into the environment. Thus, the Load Capacity, Load Allocation and Waste Load Allocation for this TMDL are zero.

4. Margin of Safety

The fish consumption advisory that has been in effect for Pleasant Hill Lake since 1985 has just been discontinued. Since chlordane has been banned, chlordane levels in fish are predicted to continue to decline. To ensure that public health and safety are protected, if future monitoring

[5] Data can be collected as sum-of-the-isomers chlordane and in that case the action level is 0.1 mg/kg sum-of-the-isomers chlordane. This is usually comparable to FDA's action level of 0.3 mg/kg technical grade chlordane when the contamination is recent because there is a lot of the technical chlordane still present. However, after a few years the chlordane all breaks down to the isomers, so the comparison no longer works well. For the purposes of this TMDL, 0.3 mg/kg technical grade chlordane will be used.

shows a rise in fish tissue chlordane, the fish consumption advisory will be reissued and the cause and cure for the increase will be investigated.

5. Seasonal Variation

There is no seasonal variation associated with this TMDL.

6. Monitoring Plans for TMDL under the Phased Approach

The department will continue to request the Missouri Department of Conservation to collect fish tissue samples from Pleasant Hill Lake for chlordane analysis.

4. Implementation Plans

Since chlordane has been banned, there is no specific remediation plan for this impairment. This is a phased TMDL and if future data indicate that fish tissue chlordane levels are not continuing to decline, this TMDL will be re-opened and re-evaluated. This TMDL will be incorporated into Missouri's Water Quality Management Plan.

7. Public Participation

This water quality limited lake is included on the approved 1998 303(d) list for Missouri. Six public meetings on impaired waters to allow input from the public were held between August 18 and September 22, 1998. No comments pertaining to Pleasant Hill Lake were received during those public meetings. The department's Water Pollution Control Program developed this TMDL and placed it on public notice from August 17 to September 16, 2001. Groups receiving the public notice announcement included the Missouri Clean Water Commission, the Water Quality Coordinating Committee, the TMDL Policy Advisory Committee, Stream Team volunteers in the watershed (42), the appropriate legislators (5) and others that routinely receive the public notice of NPDES permits. No comments were received. A copy of the notice is included in the Pleasant Hill file.

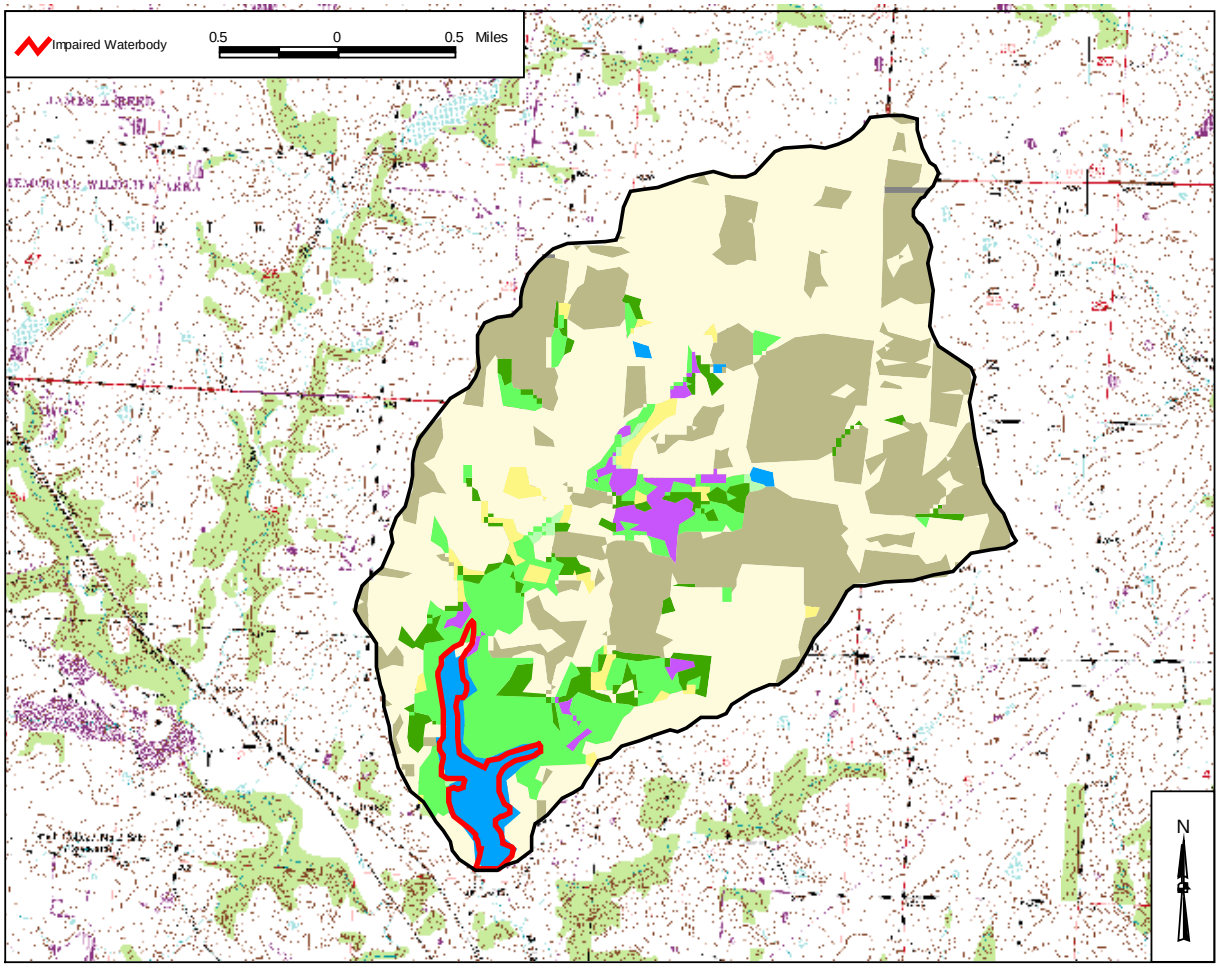
8. Appendices and List of Documents on File with the Department

Appendix A – Land Use Types for the Pleasant Hill Lake Watershed
Appendix B – Location Map of Impaired Water Body
Appendix C – Data with Discussion

Other Information on File:

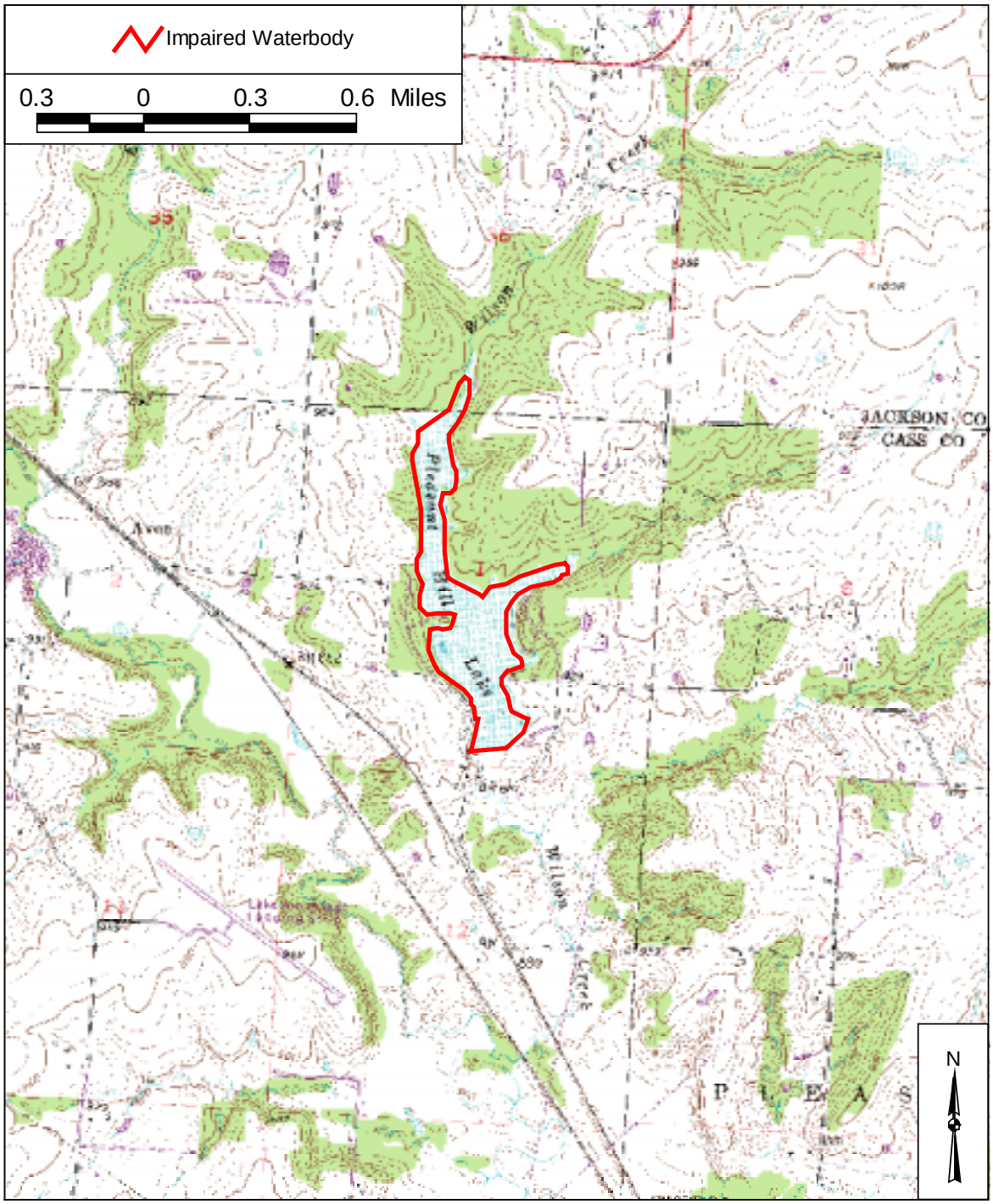
- Fish Consumption Advisories from 1985 to the present outlining safe consumption of fish.
- "Relationship Between Fish Consumption and Serum Chlordane Levels" by Evans, et al, 6/94, *Journal of Environmental Health.* This paper studied the appropriateness of fish consumption advisories in Missouri rivers. It concluded health advisories based upon fish sampling techniques do not reflect the risk of exposure to chlordane. After this study, the Missouri Department of Health changed its fish advisories from *where* fish were taken to *how much* fish was consumed.
- Public notice announcement and Information Sheet

Appendix A. Land Use Types for Pleasant Hill Lake Watershed (10290108-060003)



Land Use Type	Area (acres)
Urban Impervious	0
Urban Vegetated	0
Barren or Sparsely Vegetated	3
Row and Close Grown Crops	950
Cool-season Grassland	1596
Warm Season Grassland	65
Glade Complex	0
Eastern Redcedar and Redcedar-Deciduous Forest and Woodland	12
Deciduous Woodland	119
Upland Deciduous Forest	322
Shortleaf Pine-Oak Forest and Woodland	0
Shortleaf Pine Forest and Woodland	0
Bottomland Deciduous Forest and Woodland	66
Swamp	0
Marsh and Wet Herbaceous Vegetation	0
Open Water	112

Appendix B. Map of Impaired Waterbody
Pleasant Hill Lake, Cass County, Missouri



APPENDIX C
Data for Pleasant Hill Lake with Discussion

The data for Pleasant Hill Lake (Table 1) have not been collected consistently. Though the Missouri Department of Conservation collects and analyzes fish tissue every year, it does not analyze fish from Pleasant Hill Lake every year. Table 2 lists the data for carp and catfish. These are bottom dwelling fish and are exposed to chlordane while feeding or dwelling near chlordane-contaminated sediments. The graph uses the data from Table 2.

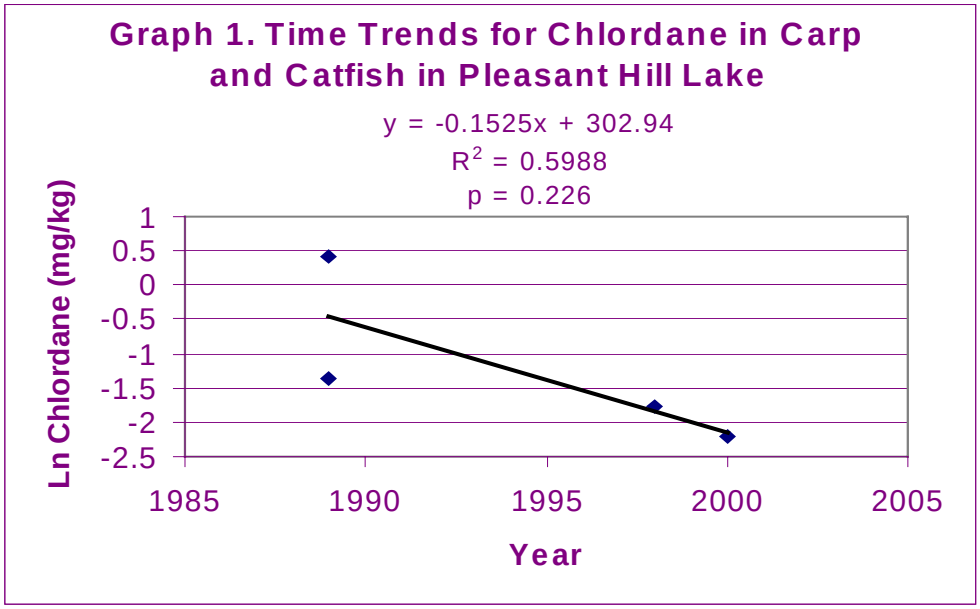
Table 1. Available Data on Chlordane in Fish Tissue from Pleasant Hill Lake Cass County, MO (mg/kg)

Species	Year	Chlordane
Carp	1989	1.51
Channel Catfish	1989	0.255
Carp	1998	0.17
Largemouth Bass	1998	0.015
Carp	2000	0.11
Largemouth Bass	2000	0.015

Table 2. Chlordane in Carp and Catfish by Year (mg/kg)

Year	Chlordane	Ln Chlordane
1989	1.51	0.412109651
1989	0.255	-1.36649173
1998	0.17	-1.77195684
2000	0.11	-2.2072749

Graph 1 is based on the natural log (Ln) of the chlordane data, which allows a linear regression (straight-line graph). From this graph, an analysis was performed to determine if the chlordane concentrations are decreasing with time. The result was that the data changes were not significantly different that that which would be explained by chance, such as environmental variations or sampling and analytical errors. That is, the data is not clearly changing with time. The statewide fish consumption advisory has been discontinued by DOH due to decline in chlordane for two monitoring periods. The department intends to continue monitoring for chlordane in fish tissue to verify the decline.



Data Sources: Missouri Departments of Natural Resources and Conservation